National Collaborative Mapping of Forests and Natural Resources From a Government Initiative - The Rural Environmental Registry (CAR)

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¹Brazilian Forest Service – Ministry of the Environment

Boston
August 2017
The Brazilian Forest Service is an institution under the Ministry of Environment whose mission is to promote the economic and sustainable use of Brazilian forests with a view to integrating forest-based development in the country's economic and strategic agenda.
What will be presented?

- Legal Aspects and Characteristics of the Development of CAR
- General Aspects About Brazil’s Forest Coverage
- Specificities of Implementation and Architecture of CAR
- Modules, Procedures and Environments for Data Acquisition, Analysis, Monitoring, Consulting and Publishing
- Some Results
- Brief list with the FOSS technologies that were used
- Future Challenges
“The implementation of an effective “Cadastre” (Registry) in Brazil is a historic challenge. The absence of this instrument means constraints to tenure security, social justice and economic development. Especially in the Amazon, the lack of a Cadastre complicates the management of public lands, regularization of adverse possessions, encourages irregular exploitation of natural resources, increases land conflicts, reduces the ability to recognize land rights and limits the sustainable development.

...many laws created different “cadastres” during Brazil’s history ...there are several institutions aimed to manage the cadastre in Brazil... the way it is today more efforts are required to conceal and integrate the work of different governmental agencies.”

*Brazil towards an effective cadastre with SIGEF
Thiago Marra, Kilder Barbosa, Eduardo Oliveira
Institute of Colonization and Land Reform INCRA, Brazil
Paper prepared for presentation at the “2015 World Bank Conference On Land And Poverty”
## GENERAL FRAMEWORK

### BRASILIAN LAND REGISTRY SYSTEMS

<table>
<thead>
<tr>
<th>Main Object</th>
<th>Name</th>
<th>Scope</th>
<th>Urban / Rural</th>
<th>Legal Act</th>
<th>Institution</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Land tenure</td>
<td>National Cadastre of Rural Land - CNIR</td>
<td>Federal</td>
<td>Rural</td>
<td>Law 10.267/2011</td>
<td>INCRA, RFB (revenue federal agency), Registry</td>
<td>Support taxation, supervision of land social function and knowledge of land distribution</td>
</tr>
<tr>
<td>Land tenure</td>
<td>Land Cadastre and Registry System - SICART + Multipurpose Technical Cadastre - CTM</td>
<td>Municipal</td>
<td>Urban</td>
<td>Portaria 511/2009 - Ministry of Cities</td>
<td>Prefeitura, Registry</td>
<td>Creation, establishment and updating of official and systematic territorial inventory of the city (multipurpose by definition)</td>
</tr>
<tr>
<td>Land tribute</td>
<td>CaFIR / ITR</td>
<td>Federal</td>
<td>Rural</td>
<td>Law 9.393/1996</td>
<td>RFB</td>
<td>Tax application of rural property - ITR</td>
</tr>
<tr>
<td>Land tribute</td>
<td>Multipurpose Technical Cadastre - CTM</td>
<td>Municipal</td>
<td>Rural or Urban</td>
<td>Portaria 511/2009 - Ministério das Cidades</td>
<td>Prefeitura</td>
<td>Creation, establishment and updating of official and systematic territorial inventory of the municipality</td>
</tr>
<tr>
<td>Land use and occupation</td>
<td>Rural Cadastre National System - SNCR</td>
<td>Federal</td>
<td>Rural or Urban</td>
<td>Law 5.868/1972</td>
<td>INCRA</td>
<td>Promote integration and systematization of data collection, research and treatment of data and information on the use and ownership of land (Decree 72,106 / 73)</td>
</tr>
</tbody>
</table>

| Land Use               | Rural Environmental Registry - CAR                                  | Federal/State  | Rural         | Law 12.651/2016          | Brazilian Forest Service | Forest development, collect environmental attributes for monitoring and Forest Law enforcement |

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Adapted from Marra, Barbosa, Oliveira; 2015
<table>
<thead>
<tr>
<th>ACTORS</th>
<th>ACTIVITIES AND RESPONSIBILITIES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Owners or Holders</td>
<td>Register in the SICAR</td>
</tr>
<tr>
<td>Environmental Agencies of the States (OEMAs)</td>
<td>Analyse CAR and Report</td>
</tr>
<tr>
<td></td>
<td>Elect Solution</td>
</tr>
<tr>
<td></td>
<td>Develop PRA</td>
</tr>
<tr>
<td></td>
<td>Sign Agreement</td>
</tr>
<tr>
<td></td>
<td>Endorse CAR</td>
</tr>
<tr>
<td></td>
<td>Offer CRA</td>
</tr>
<tr>
<td></td>
<td>Endorse CRA</td>
</tr>
<tr>
<td>Federal Government (SFB/MMA)</td>
<td>Develop SICAR</td>
</tr>
<tr>
<td></td>
<td>Manage SICAR Users</td>
</tr>
<tr>
<td></td>
<td>Enable Entities of the Bond Market</td>
</tr>
<tr>
<td></td>
<td>Issue CRA</td>
</tr>
<tr>
<td>Securities Market Entities</td>
<td>Trade Environmental Reserve Quota (CRA) in the Bond Market</td>
</tr>
<tr>
<td></td>
<td>Update SICAR (Buy and Sell)</td>
</tr>
<tr>
<td>Others (Banks, Notaries, Control Bodies, etc.)</td>
<td>Check the Compliance Status of the Rural Property to the New Forest Code</td>
</tr>
</tbody>
</table>

Monitoring Rural Property
Legal Aspects

Law 12.651/2012 – “New” Forest Code

The Rural Environmental Registry – CAR:

• National level
• Mandatory for all rural properties
• Database for:
  - control and monitoring;
  - environmental and economic planning
  - support to combat deforestation.
Legal Aspects

• Declaratory nature
• Identification of land owner
• Information about the property including geolocation of:
  - Perimeter of rural property;
  - Areas with remnants of native vegetation;
  - Permanent Protected Areas and Legal Reserve;
  - Converted areas
• Small farmers: Support + special conditions
• SICAR got online: May 2014
• Deadline: December 2017
Characteristics of CAR

• Bottom-up (can be made by the landowners themselves).
• 100% FOSS developed by a federal university (Lavras Federal University – UFLA).
• All data must be analyzed and approved individually by each state.
• SICAR needs to consume of and provide for services of other systems from federal and states governments at real time.
• The registry’s database needs to be connected to the Central Bank to issue monetary titles over the forest cover surplus (Environmental Reserve Quota).
• Cannot be used to certify rights of property or possession.
• Automatic filters generate alerts for the land owners.
SICAR implementation in the federal States

2014

2016
Brazilian forests account for 460 million ha (more than 54% of the total area of the country)
National Registry of Public Forests (2016)

Public Forests: 312.6 million hectares (37% of the territory)

Federal Public Forests: 230 million hectares
State Public Forests: 82 million hectares

Public Forests concessions: 26 Units
1.2 million hectares (Federal Forests)
0.5 million hectares (State Forests)
THE SYSTEM OF THE RURAL ENVIRONMENTAL REGISTRY - SICAR

Architecture
SICAR - architecture

- National SICAR Offline
- SICAR (States) Registration module
- SICAR (States) Analysis module
- National SICAR Analysis module
- National SICAR Regularization module
- Communication Center (Web portal)
- Registration receipt
- Other institutions (IBAMA, INCRA, etc)
- CAR Nacional DB
- National SICAR Report and monitoring modules
- CAR Status Statement
- National SICAR Reception module
- Webservice
- State DB
REGISTRATION MODULE

(Data Acquisition)
Registration module (Offline Desktop App)

**CADAVER AMBIENTAL RURAL**

- **BAIXAR IMAGENS**: Obtain images of municipalities
- **CADASTRAR**: Register immobiles, visualize cadastrados
- **GRAVAR PARA ENVIO**: Save the cadastrados
- **ENVIAR**: Send cadastrados
- **RETIFICAR**: Rectify imóveis já cadastrados

- Mosaic Download by municipality
- Mosaic Download by municipality
- Saving to send (".car")
- Send ".car"
- Registry Rectification
Title and personal information

<table>
<thead>
<tr>
<th>Cadastrante</th>
<th>Imóvel</th>
<th>Dominio</th>
<th>Documentação</th>
<th>Geo</th>
<th>Informações</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th><strong>Dados do Documento</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Propriedade ou Posse</strong>:</td>
</tr>
<tr>
<td>Propriedade</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Nome da Propriedade</strong>:</th>
<th><strong>Área (ha)</strong>:</th>
<th><strong>Tipo de Documento</strong>:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Selecione</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Número da Matrícula ou Documento</strong>:</th>
<th><strong>Data do Documento</strong>:</th>
<th><strong>Livro</strong>:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Folha</strong>:</th>
<th><strong>UF do Cartório</strong>:</th>
<th><strong>Município do Cartório</strong>:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Selecione</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Código no Sistema Nacional de Cadastro Rural - SNCR</strong>:</th>
<th><strong>Certificação do Imóvel no INCRA</strong>:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>NIRF (Número de Inscrição do Imóvel Rural na Secretaria da Receita Federal do Brasil)</strong>:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Possui Reserva Legal Averbada e/ou Reserva Legal Aprovada e não Averbada?</strong>:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sim</td>
</tr>
</tbody>
</table>

Registry Number of INCRA or Rural Revenue Service
NATIVE VEGETATION
HYDROGRAPHY
RECIBO DE INSCRIÇÃO DO IMÓVEL RURAL NO CAR

Registro no CAR: MT-5105150-2999985B62894F20A7468A086695934AF  Data de Cadastro: 07/03/2016 23:30:18

RECIBO DE INSCRIÇÃO DO IMÓVEL RURAL NO CAR

Nome do Imóvel Rural: Casa do Uso L_TCC
Município: Juina  UF: Mato Grosso
Coordenadas Geográficas do Centroide do Imóvel Rural: Latitude: 11°21'35,61" S  Longitude: 59°10'46,33" O
Área Total (ha) do imóvel Rural: 100,1627  Módulos Fiscais: 1,00
Código do Protocolo: MT-5105150-82592A7B80C524374D5FE2762C28B18A

ÁREAS DECLARADAS (em hectares)

<table>
<thead>
<tr>
<th>Imóvel</th>
<th>Imóvel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Área Total do Imóvel</td>
<td>100,1627</td>
</tr>
<tr>
<td>Área Consolidada</td>
<td>46,6527</td>
</tr>
<tr>
<td>Área de Serviço Administrativo</td>
<td>0,0000</td>
</tr>
<tr>
<td>Remanescente de Vegetação Nativa</td>
<td>53,5190</td>
</tr>
<tr>
<td>Área Líquida do Imóvel</td>
<td>100,1627</td>
</tr>
<tr>
<td>Reserva Legal</td>
<td>53,5190</td>
</tr>
<tr>
<td>APP / Uso Restrito</td>
<td>Área de Reserva Legal</td>
</tr>
<tr>
<td>Área de Preservação Permanente</td>
<td>0,0000</td>
</tr>
<tr>
<td>Área de Uso Restrito</td>
<td>0,0000</td>
</tr>
</tbody>
</table>

INFORMAÇÕES GERAIS

1. Este documento garante o cumprimento do disposto nos §§ 2º do art. 14 e § 3º do art. 29 da Lei nº 12.851, de 2012, e se constitui em instrumento suficiente para atender ao disposto no art. 78-A da referida Lei.
2. O presente documento representa a confirmação de que foi realizada a declaração do imóvel rural no Cadastro Ambiental Rural-CAR e que está sujeito à validação pelo órgão competente;
3. As informações prestadas no CAR são de caráter declaratório;
4. Os documentos, especialmente os de caráter pessoal ou domínial, são de responsabilidade do proprietário ou possuidor rural declarante, que ficam sujeitos às penas previstas no art. 298. do Código Penal (Decreto-Lei nº 2.848, de 7 de setembro de 1940) e no art. 66-A da Lei nº 9.665, de 12 de fevereiro de 1998;
5. O demonstrativo do quadro das informações declaradas no CAR, relativas às áreas de Preservação Permanente, de uso restrito e de Reserva Legal poderá ser acompanhado no site eletrônico www.car.gov.br.
Reference layers for rectification

- Mosaics (Landsat 2008 and Rapideye 2011)
- Protected/restricted areas
- Other registered landholds
- Classified coverages
### CAR – Declared information

<table>
<thead>
<tr>
<th>Total area subject to registration (ha)</th>
<th>Total Registered Area (ha)</th>
<th>Registered area (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>397,836,864</td>
<td>411,001,629</td>
<td>over 100 %</td>
</tr>
</tbody>
</table>

Number of Registered Properties: **4,275,970**  
(ref. July 2017)

**Increment (July/2017)**

2,410,521 (ha)
Permanent Protected Areas, Legal Reserves and native vegetation (declared: March 2017)

Área de Unidades de Conservação¹: 111,9 milhões ha

Área de RL, APP e Vegetação Nativa: 166 milhões ha
Water Springs (declared – march 2017)

1,456,628 water springs declared

CAR declared water springs
State limits
Data Consistency

Remnants of Native Vegetation, Permanent Protected Areas and Legal Reserve
Public consultation platform

CAR status (Decree nº 8.235/2014)

http://www.car.gov.br/#/consultar

Information regarding:

• CAR status;
• Analysis status;
• Legal reserve surplus
• pending restoration of Permanent Protected Areas and Legal Reserves;
• Overlap and other restrictions.
### Restrições do IR

<table>
<thead>
<tr>
<th>Origem</th>
<th>Descrição</th>
<th>Processamento</th>
<th>Área de conflito (ha)</th>
<th>Percentual (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unidade de Conservação</td>
<td>Parque Nacional - Parna do Juruena</td>
<td>01/05/2016</td>
<td>31.635.8491</td>
<td>99,98</td>
</tr>
<tr>
<td>Terra Indígena</td>
<td>Apiaká do Pontal e Isolados</td>
<td>01/06/2016</td>
<td>31.635.0043</td>
<td>99,08</td>
</tr>
</tbody>
</table>
ACCESSING CAR PUBLIC DATA

http://www.car.gov.br/publico/imoveis/index
IMÓVEIS

REGULARIDADE

RESTRIÇÕES

BASE DE DOWNLOADS

Versão 1.0

Castro

total de imóveis: 3.032

Area cadastrada: 185.128,19 ha

Intraf Federal

MINISTÉRIO DO MEIO AMBIENTE

BRASIL
Versão 1.0

Castro

total de imóveis: 3.032

Área cadastrada: 185.128,19 ha
<table>
<thead>
<tr>
<th>Municipality</th>
<th>Municipality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acrelândia</td>
<td>Assis Brasil</td>
</tr>
<tr>
<td>Brasiléia</td>
<td>Bujari</td>
</tr>
<tr>
<td>Capixaba</td>
<td>Cruzeiro do Sul</td>
</tr>
<tr>
<td>Epitaciolândia</td>
<td>Feijó</td>
</tr>
<tr>
<td>Jordão</td>
<td>Mâncio Lima</td>
</tr>
<tr>
<td>Manoel Urbano</td>
<td>Marechal Thaumaturgo</td>
</tr>
<tr>
<td>Plácido de Castro</td>
<td>Porto Acre</td>
</tr>
<tr>
<td>Porto Walter</td>
<td>Rio Branco</td>
</tr>
<tr>
<td>Rodrigues Alves</td>
<td>Santa Rosa do Purus</td>
</tr>
<tr>
<td>Senador Guiomard</td>
<td>Sena Madureira</td>
</tr>
<tr>
<td>Tarauacá</td>
<td>Xapuri</td>
</tr>
</tbody>
</table>

Csv and shapefile download by municipality
COMMUNICATION CENTER

Keeping up with CAR analysis and regularization

395,700
Registered users (April/2017)
Central do Proprietário/Possuidor:

Já tenho cadastro:
CPF / CNPJ:
CPF / CNPJ

Senha:
Senha

Não tenho cadastro:
Informe o Número do Recibo:
UF-1302405-E8D3.395B.6D27.4F42.AE22.DD56.987C.DD52
Informar o CPF / CNPJ:
CPF / CNPJ

Realize o cadastro e acompanhe as mensagens e notificações relacionadas aos imóveis cadastrados em seu CPF / CNPJ:

Navegadores Compatíveis:
Keeping up with analysis results and CAR status
Communication Center (landowners)

Instant messaging and access to documents of the analysis

<table>
<thead>
<tr>
<th>Data</th>
<th>Hora</th>
<th>Assunto</th>
</tr>
</thead>
<tbody>
<tr>
<td>03/03/2016</td>
<td>14:40:01</td>
<td>Seu imóvel foi analisado</td>
</tr>
<tr>
<td>03/03/2016</td>
<td>14:30:01</td>
<td>Seu cadastro está em análise pela equipe técnica</td>
</tr>
<tr>
<td>14/02/2016</td>
<td>22:54:01</td>
<td>Indício de sobreposição com Terra Indígena</td>
</tr>
<tr>
<td>14/02/2016</td>
<td>22:54:01</td>
<td>Indício de sobreposição entre imóveis rurais</td>
</tr>
</tbody>
</table>
Communication Center (landowners)

CAR correction and possibility to send complementary information/documents
ANALYSIS MODULE

Analysis of overlaps and notification
Analysis of overlaps (detailed for a single CAR)

Amongst landholds
Indigenous lands
Conservation Units (National Parks, etc)
Embargos
Agrarian reform settlements
ANALYSIS MODULE

Analysis of declared land cover and native vegetation
Land cover analysis
Land cover analysis

CONVERTED AREAS

CAR (MAPPING)
Land cover analysis

NATIVE VEGETATION
CAR (MAPPING)
Land cover analysis

MAPPED AREAS

CAR (Forest Code)
Land cover analysis
Land cover analysis

NATIVE VEGETATION (DECLARED)
Land cover analysis

- NATIVE VEGETATION (DECLARED)
- CONVERTED AREAS
  CAR (MAPPING)
Land cover analysis

CONVERTED AREAS CAR (MAPPING)

NATIVE VEGETATION (DECLARED)

Automatic Indication of Inconsistencies
ANALYSIS MODULE

Analysis of the Legal Reserve
Analysis of the legal reserve – deficits and surplus
Analysis of the legal reserve – deficits and surplus
CAR, PRA and other Information Systems on Forests at national level

- CAR and PRA systems
- CRA – Environmental Reserve Quota
- Registry of Forestry Enterprises and Environmental Licensing (new)
- Licensing for Forest management and authorization for suppression of native vegetation (new)
- Document about Origins of Forest Products
- Timber traceability / chain of custody (Public Forests Concessions)
Concessions of Public Forests

Information System for Timber Traceability

FOREST

Mapping → Inventory → Cutting and registering → Transport

INDUSTRY

Consumption/Export → Transport → Industrial Unit
Concessions of Public Forests

Information System for Timber Traceability

All trees are identified, numbered, and georeferenced.
Concessions of Public Forests

Timber Transportation
Forest Inventory – Carbon and Biomass Stored in Rural Properties

BRASIL_NDVI
ndvi_med
- -0,593000 - 0,120000
- 0,120001 - 0,400000
- 0,400001 - 0,744000

BRASIL_RFDI
dB_med
- -25,942000 - -9,500000
- -9,499999 - 0,500000
- 0,500001 - 19,398,000000
Mobile App – “River Planters”

Connecting spring owners to supporters of increasing water production

Water springs  Supporters  Suppliers

Monitoring
NEXT STEPS

Improving the Information and Data Analyses
- Implementation of the Analysis Module;
- Evaluation of environmental liability, forest assets and rural properties that comply with environmental regulations;
- Periodic dissemination of information;

Improving Public Policy Formulation and Implementation
- Tracking deforestation;
- Harmonizing agriculture and environment conservation;
- Payment for Environmental Services;
- Establishment of strategies towards conservation: recovering priority areas, ecological corridors, increasing protected areas and integrating with the National Forest Inventory.

Implementing the Program for Environmental Compliance

Regulating the Environmental Compliance Quotas - CRA
## Technologies

<table>
<thead>
<tr>
<th>Registration Module</th>
<th>Modules: Receptor + Site + Analysis + Communication Center + Access Management</th>
<th>BI – Business Intelligence</th>
</tr>
</thead>
<tbody>
<tr>
<td>NodeJS</td>
<td>Backend:</td>
<td>MongoDB</td>
</tr>
<tr>
<td>Chromium Embedded Framework (CEF)</td>
<td>• Java</td>
<td>Play Framework</td>
</tr>
<tr>
<td>SQLite</td>
<td>• Play Framework</td>
<td>Java</td>
</tr>
<tr>
<td>JavaScript</td>
<td>Database</td>
<td>jQPlot</td>
</tr>
<tr>
<td>Jade</td>
<td>• PostgreSQL</td>
<td>HTML 5 + CSS 3 + JavaScript</td>
</tr>
<tr>
<td>Less</td>
<td>• PostGis</td>
<td></td>
</tr>
<tr>
<td>Grunt</td>
<td></td>
<td></td>
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<tr>
<td>Leaflet</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Node-Geos</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Thank You!

Bernardo de Araújo Moraes Trovão

Brazilian Forest Service

Email: bernardo.trovao@florestal.gov.br

https://github.com/leandromet/Geoprocessamento---Geoprocessing
www.florestal.gov.br
www.car.gov.br